

FCC REPORT

(RFID)

Applicant: Jinan USR IOT Technology Limited

Address of Applicant: Floor 2, Wuzhou Scientific Research Building, No.1100
Shunfeng Street, Gaoxin District, Jinan, Shandong, China

Equipment Under Test (EUT)

Product Name: LoRa Gateway

Model No.: USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290

FCC ID: 2ARF7-USRLG220

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 10 Aug., 2018

Date of Test: 13 Aug., to 29 Dec., 2018

Date of report issued: 29 Dec., 2018

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	29 Dec., 2018	Original

Tested by:

Zora Lee

Date:

29 Dec., 2018

Test Engineer

Reviewed by:

Wimer Zhang

Date:

29 Dec., 2018

Project Engineer

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4 Test Summary

Test Items	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
6dB Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Conducted and radiated Spurious Emission	15.205/15.209	Pass
<i>Pass: Meet the requirement.</i> <i>N/A: Not Applicable for Non-adaptive equipment.</i>		

5 General Information

5.1 Client Information

Applicant:	Jinan USR IOT Technology Limited
Address:	Floor 2, Wuzhou Scientific Research Building, No.1100 Shunfeng Street, Gaoxin District, Jinan, Shandong, China
Manufacturer/Factory:	Jinan USR IOT Technology Limited
Address:	Floor 2, Wuzhou Scientific Research Building, No.1100 Shunfeng Street, Gaoxin District, Jinan, Shandong, China

5.2 General Description of E.U.T.

Product Name:	LoRa Gateway
Model No.:	USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290
Operation Frequency:	903-927 MHz
Channel numbers:	25
Channel separation:	1 MHz
Modulation technology:	Lora
Antenna Type:	External Antenna
Antenna gain:	1.4 dBi
Power supply:	DC 5-36V(Nominal Match: 12V, 1A)
Test Sample Condition:	The test samples were provided in good working order with no visible defects.
Remark:	Mode No.: USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290, were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.

Operation Frequency each of channel					
Channel	Frequency	Channel	Frequency	Channel	Frequency
0	903MHz	10	913MHz	20	923MHz
1	904MHz	11	914MHz	21	924MHz
2	905MHz	12	915MHz	22	925MHz
3	906MHz	13	916MHz	23	926MHz
4	907MHz	14	917MHz	24	927MHz
5	908MHz	15	918MHz		
6	909MHz	16	919MHz		
7	910MHz	17	920MHz		
8	911MHz	18	921MHz		
9	912MHz	19	922MHz		
Note: In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test. Channel No. 0, 12 & 24 were selected as Lowest, Middle and Highest channel.					

5.3 Test environment and test mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation
Remark:	Four Lora modules are same, and they cannot transmitting at the same time. During the test, pre-scan Lora1, Lora2, Lora3 and Lora4 of the modules, found Lora1 was worse case mode. The report only reflects the worst mode.
The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.	

5.4 Description of Support Units

N/A

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±2.22 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±2.76 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.28 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.72 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±2.88 dB (k=2)

5.6 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations: ● FCC - Registration No.: 727551 Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The Registration No. is 727551. ● IC - Registration No.: 10106A-1 The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1. ● CNAS - Registration No.: CNAS L6048 Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.7 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

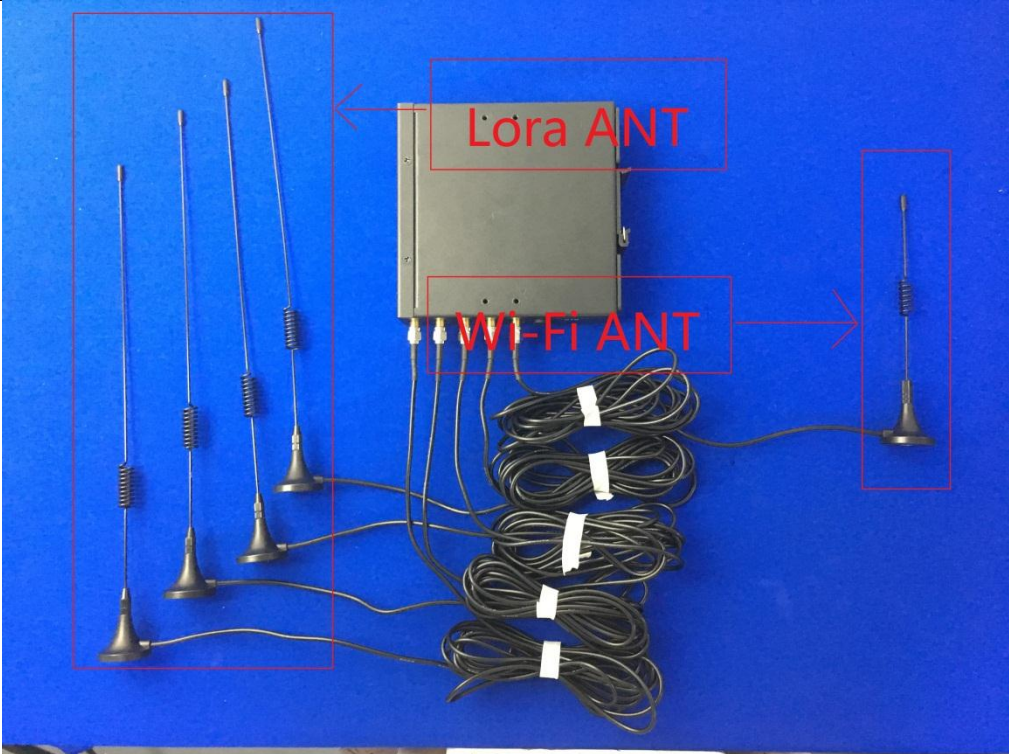
5.8 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2017	06-21-2020
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-21-2017	11-20-2018
				11-21-2018	11-20-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2018	03-06-2019
Pre-amplifier	CD	PAP-1G18	11804	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-21-2017	11-20-2018
				11-21-2018	11-20-2019
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2018	03-06-2019
Simulated Station	Anritsu	MT8820C	6201026545	03-07-2018	03-06-2019
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2018	03-06-2019
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2018	03-06-2019
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2018	03-06-2019

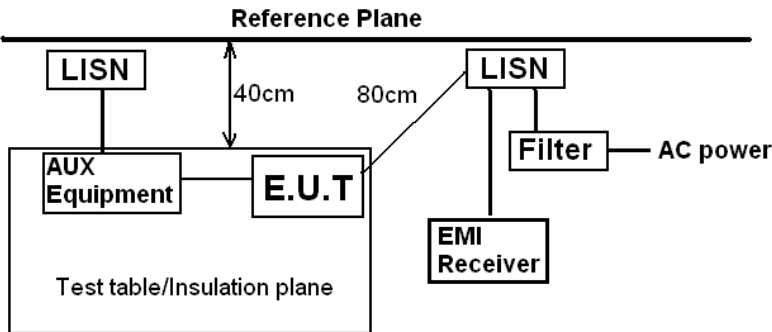
Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-07-2018	03-06-2019
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-07-2018	03-06-2019
LISN	CHASE	MN2050D	1447	03-19-2018	03-18-2019
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2018	07-20-2019
Cable	HP	10503A	N/A	03-07-2018	03-06-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		

6 Test results and Measurement Data

6.1 Antenna requirement:

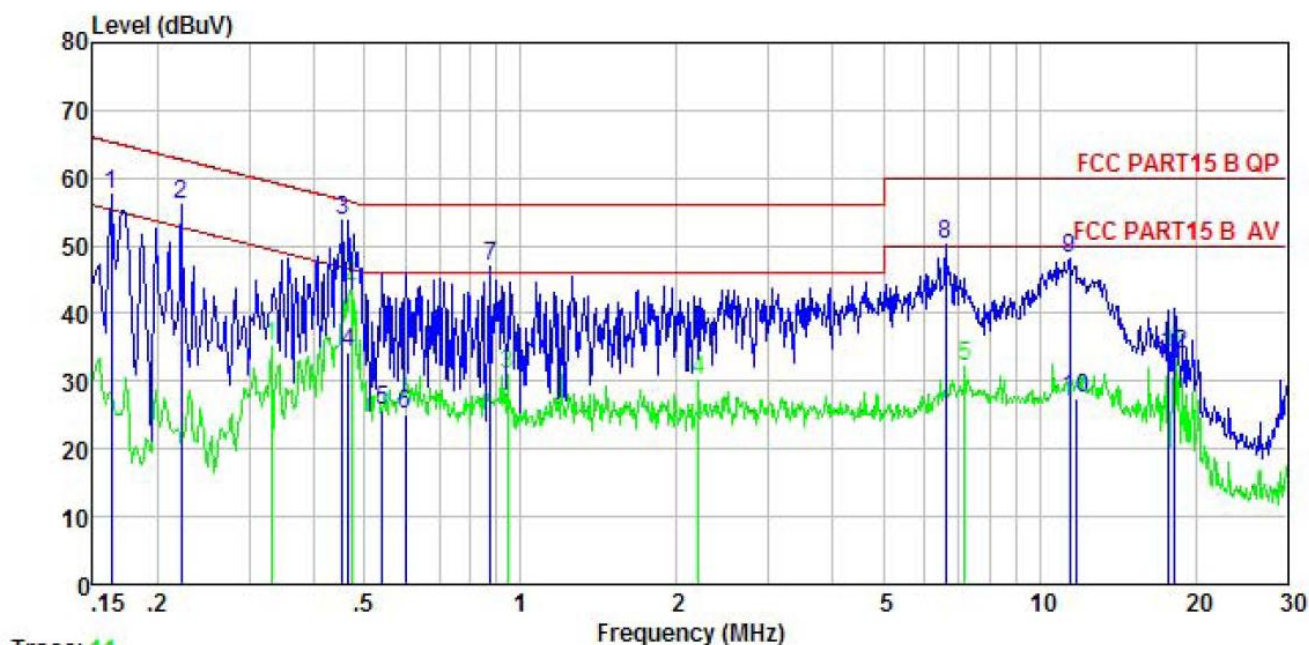
Standard requirement:	FCC Part 15 C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The LoRa antenna are External antenna which cannot replace by end-user, the best-case gain of the antenna is 1.4 dBi.	
	

6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.		
Test setup:	 Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test Instruments:	Refer to section 5.8 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Product name:	LoRa Gateway	Product model:	USR-LG220
Test by:	Zora	Test mode:	Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Humi: 55%



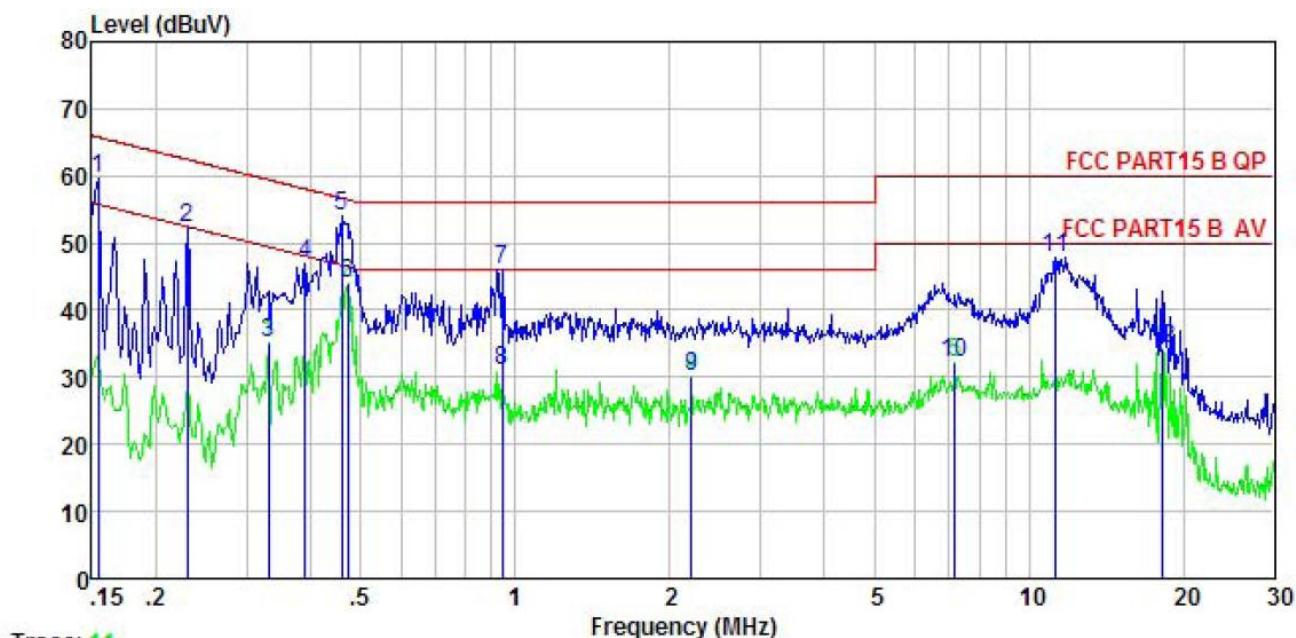
Trace: 11

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.162	46.55	0.17	10.77	57.49	65.34	-7.85	QP
2	0.222	45.22	0.14	10.76	56.12	62.74	-6.62	QP
3	0.454	42.79	0.12	10.74	53.65	56.80	-3.15	QP
4	0.466	23.44	0.12	10.75	34.31	46.58	-12.27	Average
5	0.541	14.82	0.12	10.76	25.70	46.00	-20.30	Average
6	0.601	14.11	0.13	10.77	25.01	46.00	-20.99	Average
7	0.876	36.04	0.13	10.83	47.00	56.00	-9.00	QP
8	6.592	39.16	0.24	10.81	50.21	60.00	-9.79	QP
9	11.438	36.95	0.32	10.93	48.20	60.00	-11.80	QP
10	11.745	16.26	0.32	10.92	27.50	50.00	-22.50	Average
11	17.661	21.38	0.29	10.92	32.59	50.00	-17.41	Average
12	18.232	22.68	0.29	10.92	33.89	50.00	-16.11	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

Product name:	LoRa Gateway	Product model:	USR-LG220
Test by:	Zora	Test mode:	Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%

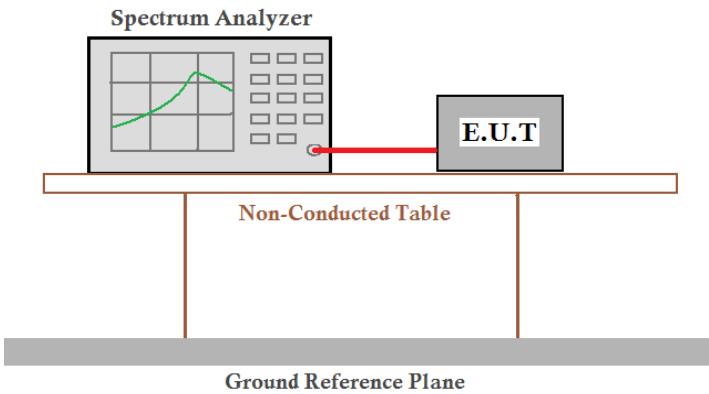


	Freq	Read	LISN	Cable	Limit	Over	
	MHz	Level	Factor	Loss	Line	Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dB	
1	0.154	47.77	0.98	10.78	59.53	65.78	-6.25 QP
2	0.230	40.60	0.94	10.75	52.29	62.44	-10.15 QP
3	0.330	23.40	0.97	10.73	35.10	49.44	-14.34 Average
4	0.389	35.32	0.97	10.72	47.01	58.08	-11.07 QP
5	0.459	42.17	0.97	10.74	53.88	56.71	-2.83 QP
6	0.471	32.32	0.97	10.75	44.04	46.49	-2.45 Average
7	0.943	34.35	0.97	10.85	46.17	56.00	-9.83 QP
8	0.943	19.28	0.97	10.85	31.10	46.00	-14.90 Average
9	2.201	18.10	0.98	10.95	30.03	46.00	-15.97 Average
10	7.175	20.21	1.02	10.81	32.04	50.00	-17.96 Average
11	11.257	35.83	0.99	10.93	47.75	60.00	-12.25 QP
12	18.232	22.64	0.76	10.92	34.32	50.00	-15.68 Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

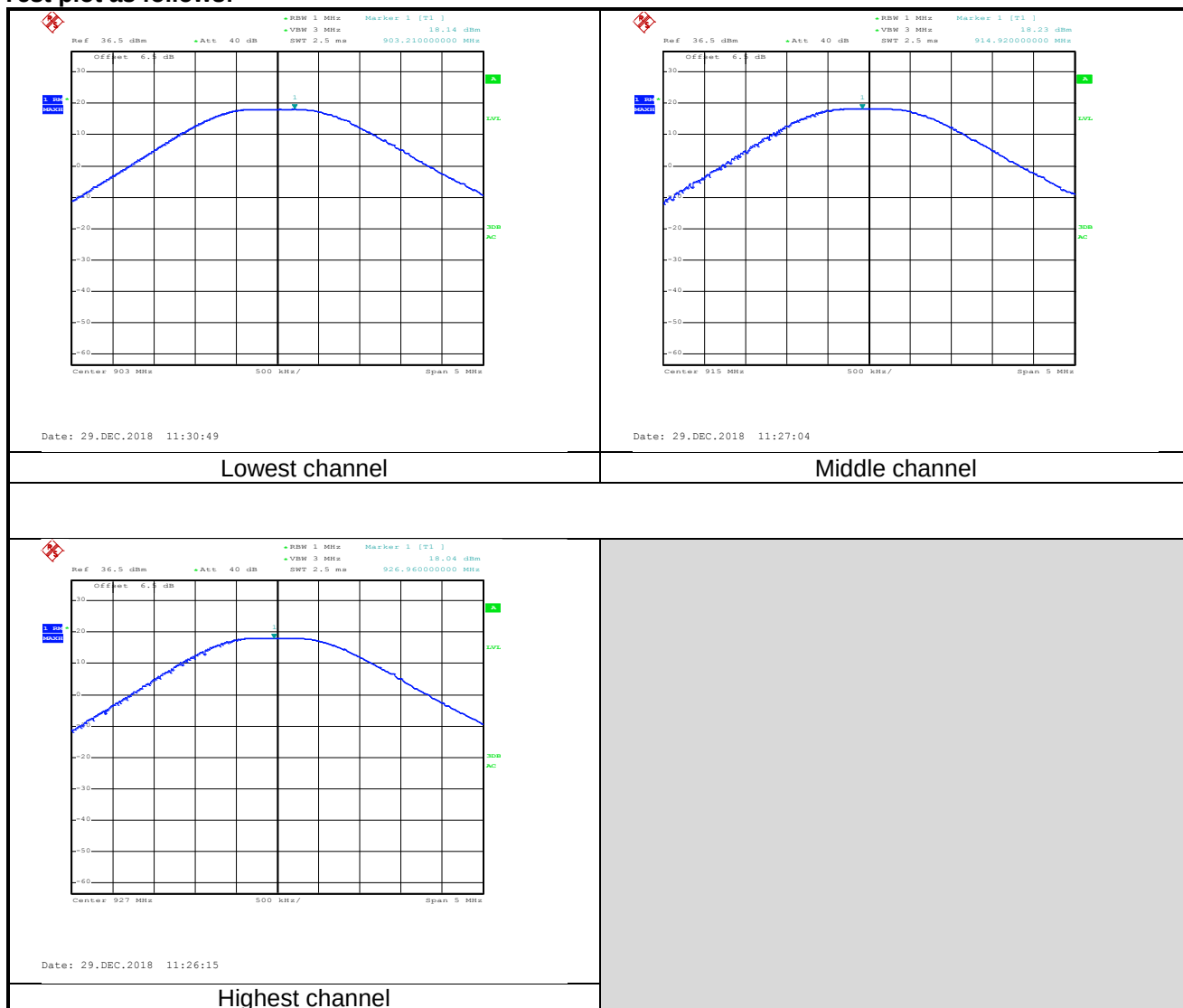
6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

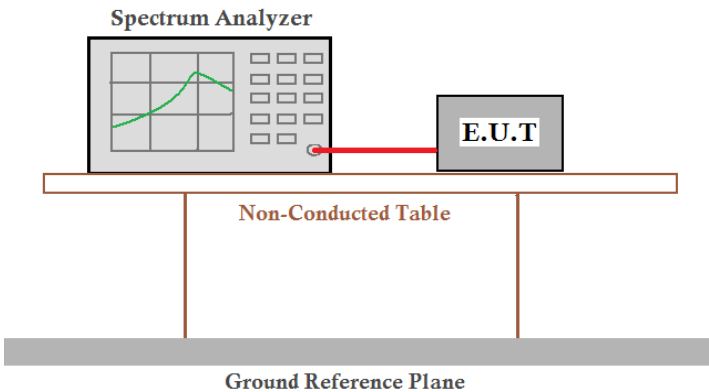
Measurement Data:

Test CH	Maximum Conducted Output Power (dBm)	Limit(dBm)	Result
Lowest	18.14	30.00	Pass
Middle	18.23		
Highest	18.04		

Test plot as follows:



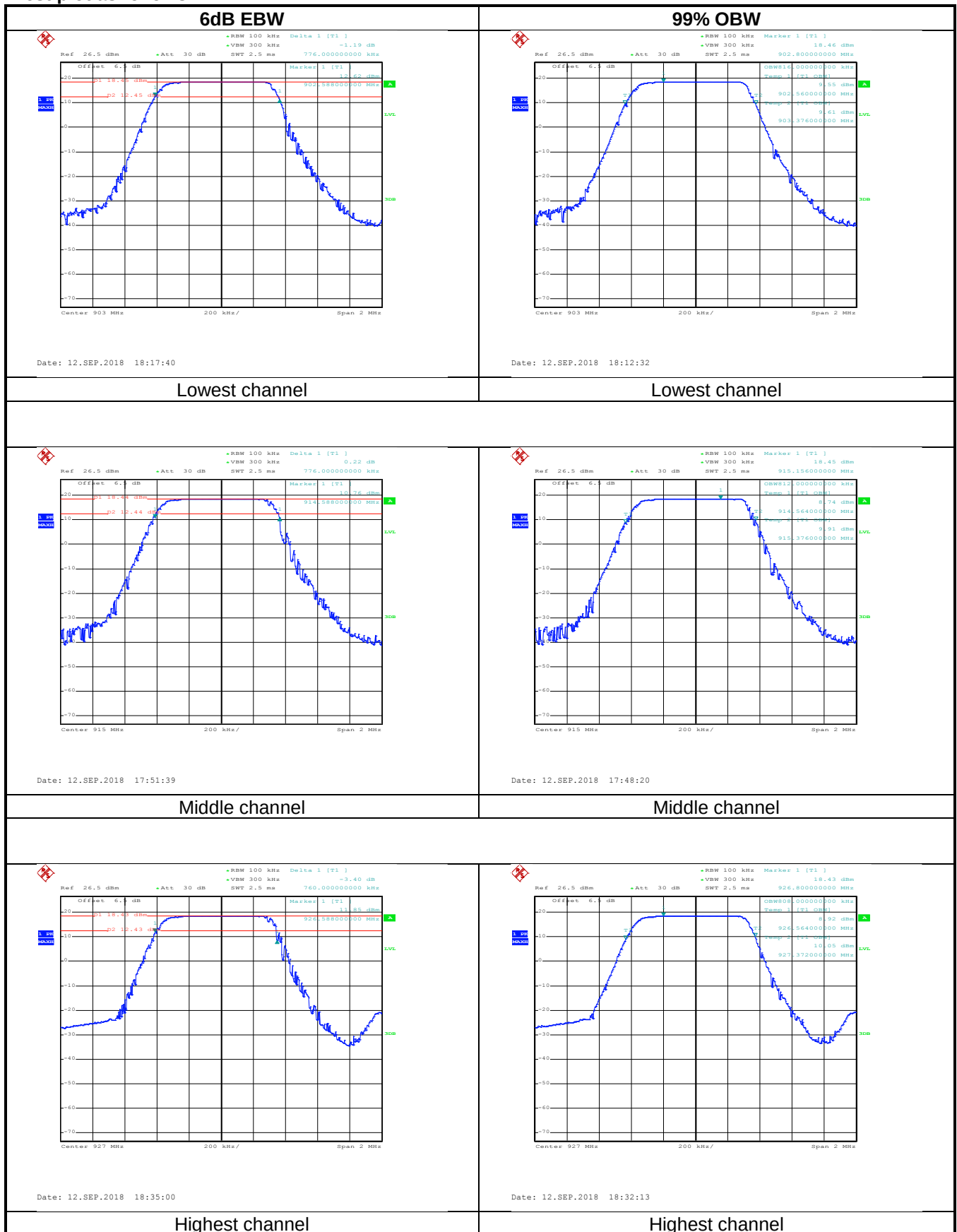
6.4 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

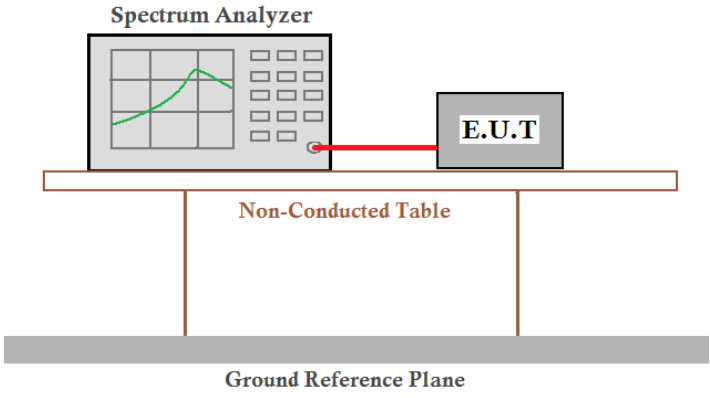
Measurement Data:

Test CH	6dB Emission Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.776	>500	Pass
Middle	0.776		
Highest	0.760		
Test CH	99% Occupy Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.816	N/A	N/A
Middle	0.812		
Highest	0.808		

Test plot as follows:



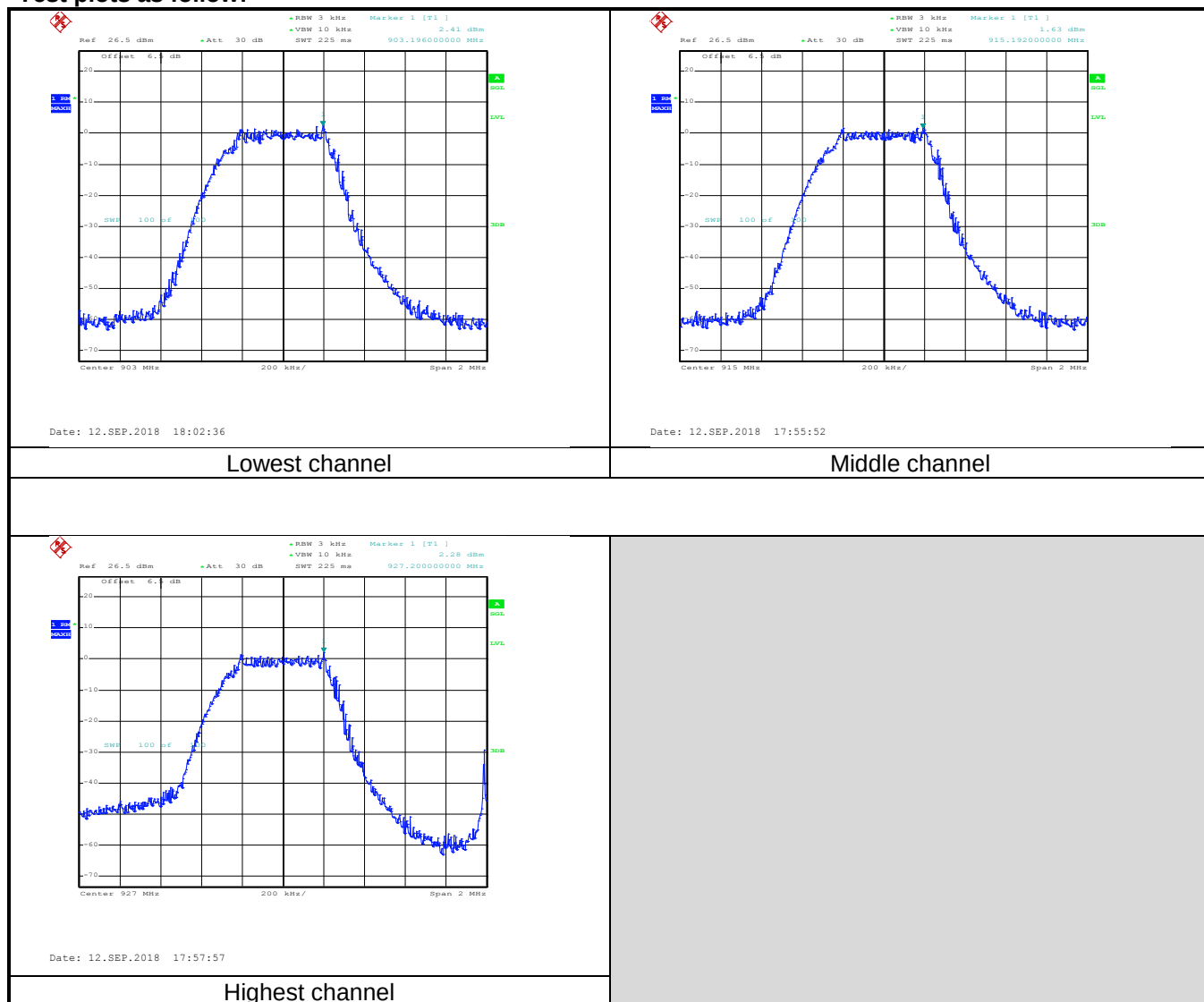
6.5 Power Spectral Density

Test Requirement:	FCC Part 15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	8 dBm
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

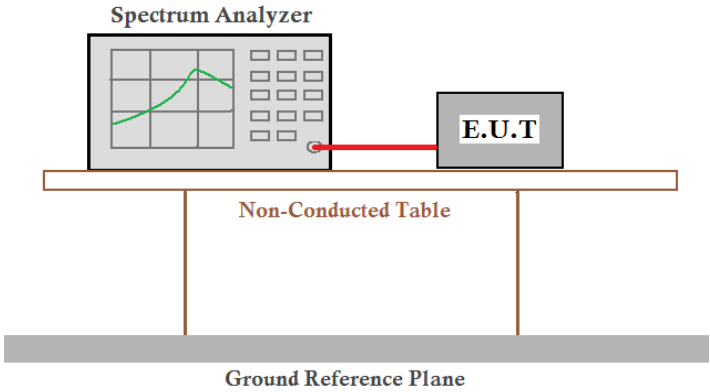
Test CH	Power Spectral Density (dBm)	Limit(dBm)	Result
Lowest	2.41	8.00	Pass
Middle	1.63		
Highest	2.28		

Test plots as follow:

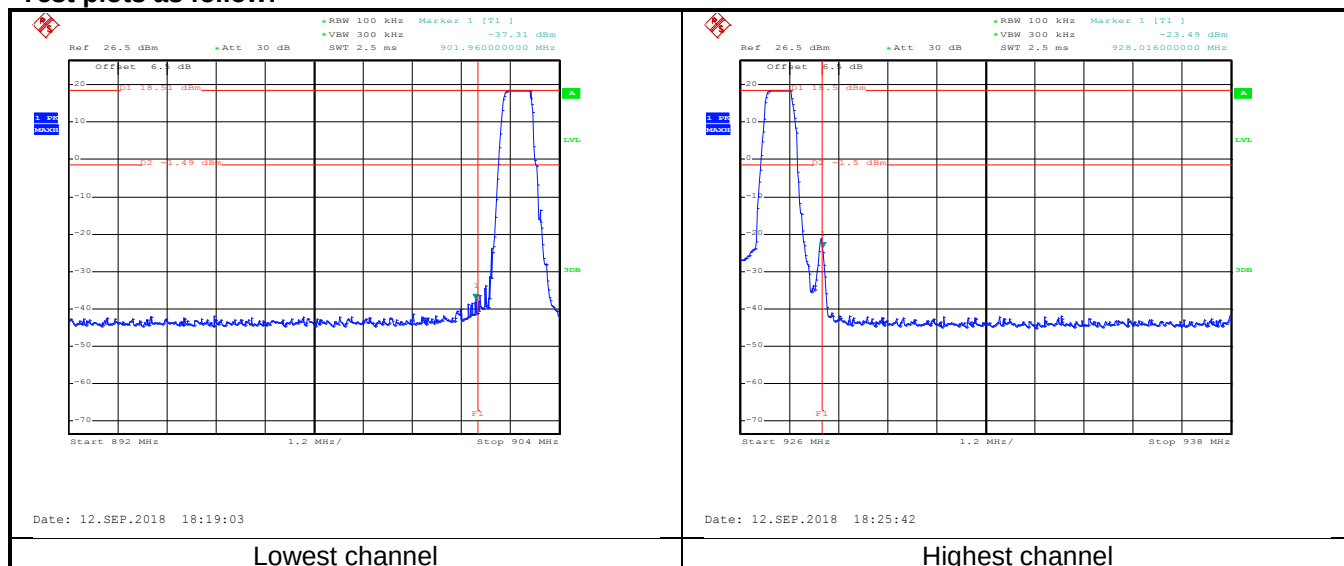


6.6 Band Edge

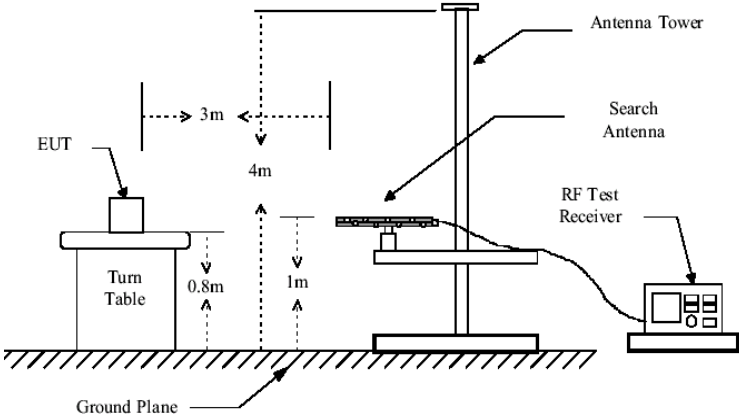
6.6.1 Conducted Emission Method

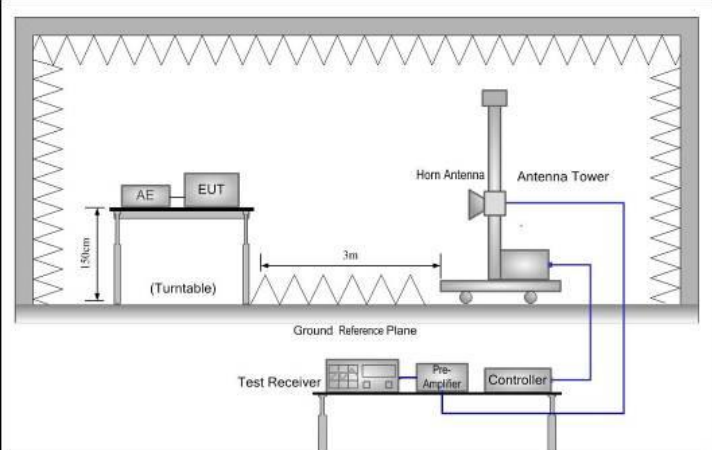
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which sits on a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Comply with 30dBc requirement , Passed

Test plots as follow:



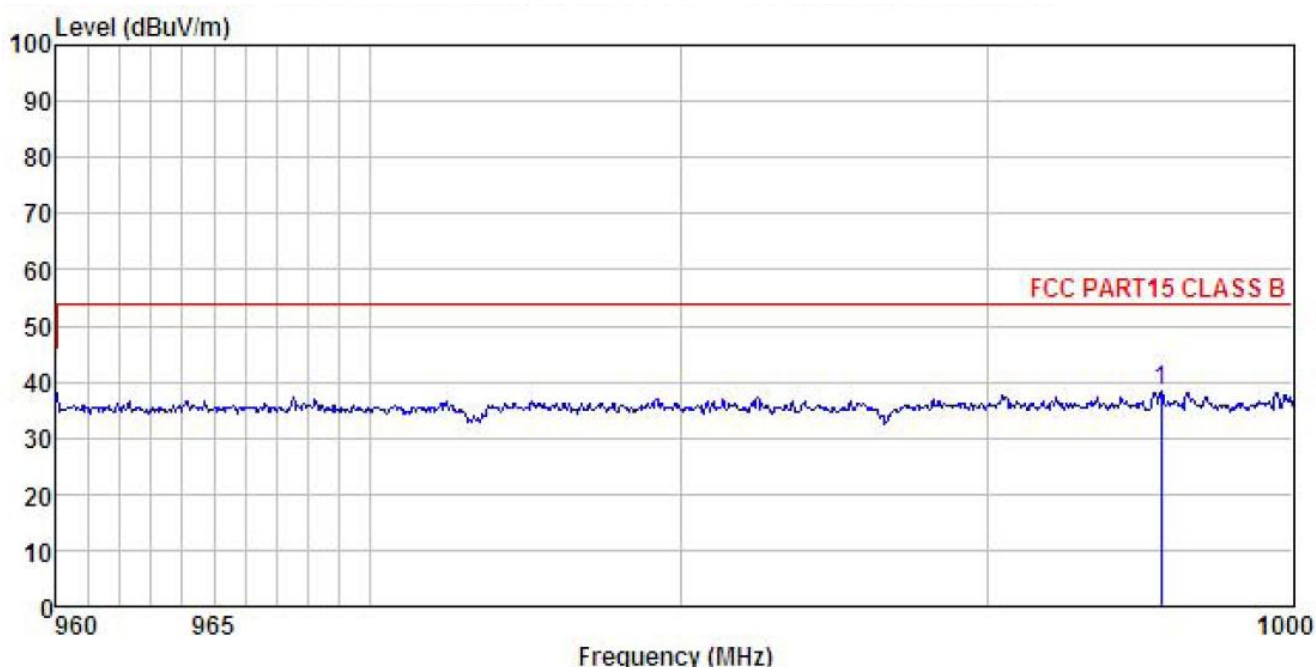
6.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013 and KDB 558074				
Test Frequency Range:	960MHz to 1.240GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	960MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency	Limit (dBuV/m @3m)		Remark	
	960MHz-1GHz	54.00		Quasi-peak Value	
	Above 1GHz	54.00		Average Value	
		74.00		Peak Value	
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz) /1.5m(above 1GHz) above the groundat a 3 meter chamber.The table was rotated 360 degrees todetermine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatablewas turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limitspecified, then testing could be stopped and the peak values of the EUT wouldbe reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified andthen reported in a data sheet.				
Test setup:	Below 1GHz 				

	Above 1GHz 
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Below 1GHz:

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Humi: 57%

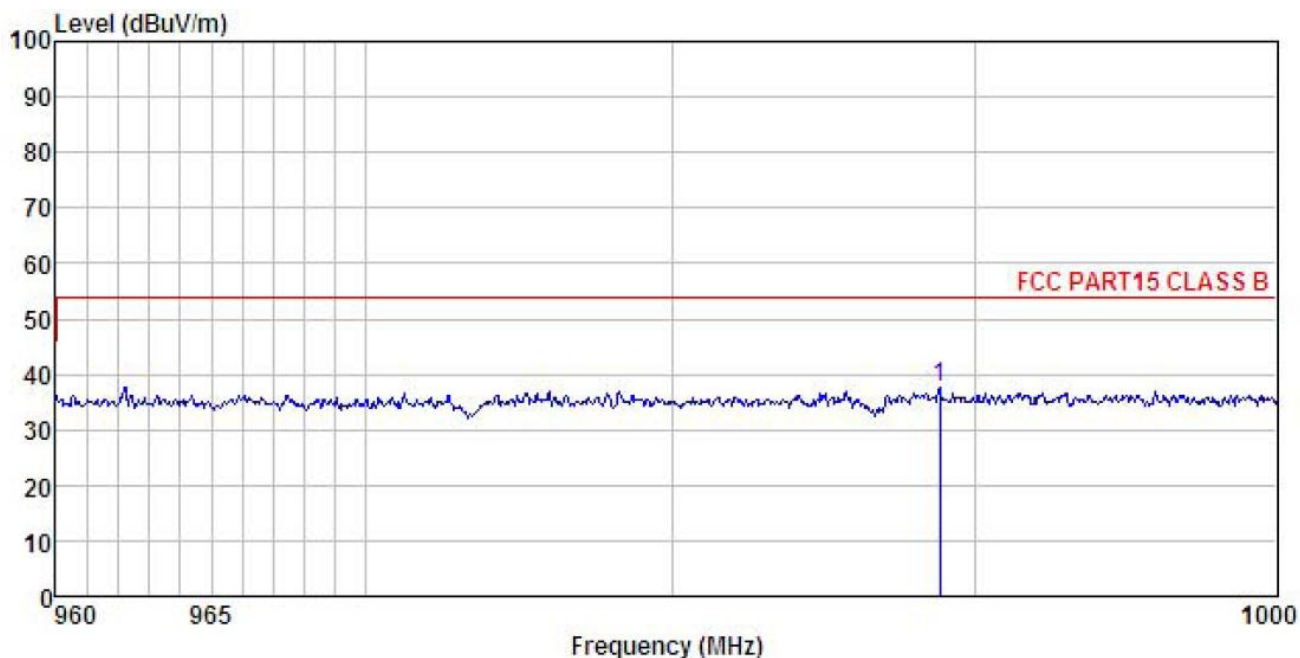


	Freq	ReadAntenna	Cable	Aux	Preamp	Level	Limit	Over	Remark
	MHz	Level	Factor	Loss	Factor	Factor	Level	Line	Limit
		dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB
1	995.642	11.17	22.77	4.45	0.00	0.00	38.39	54.00	-15.61
									QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%



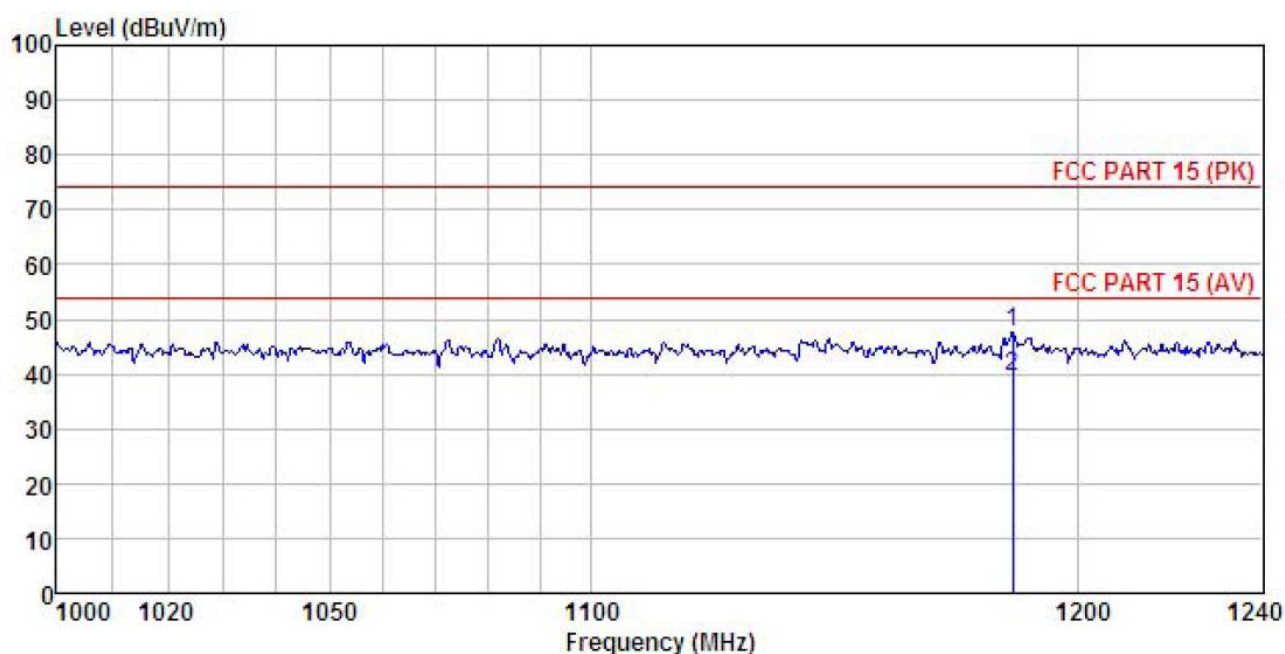
	Freq	ReadAntenna	Cable	Aux	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Factor	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB
1	988.796	10.45	22.71	4.41	0.00	0.00	37.57	54.00	-16.43 QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz:

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Humi: 57%

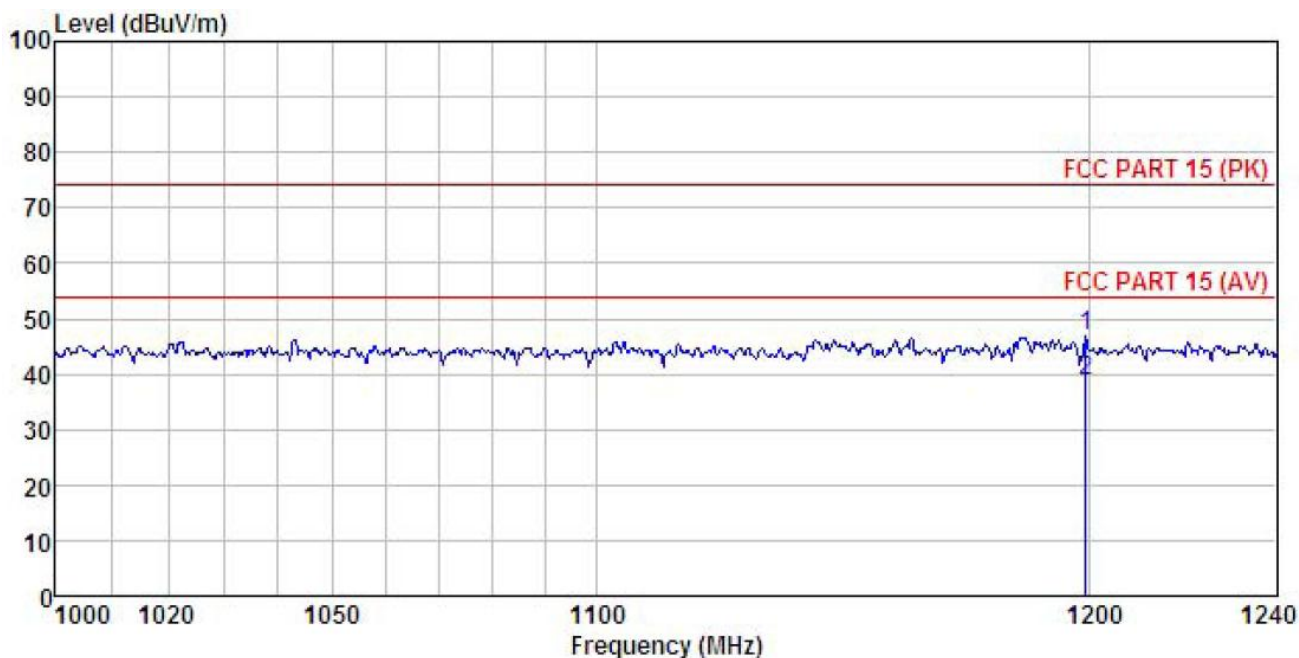


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	1185.996	20.18	24.27	3.29	0.00	0.00	47.74	74.00	-26.26	Peak
2	1185.996	11.89	24.27	3.29	0.00	0.00	39.45	54.00	-14.55	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%



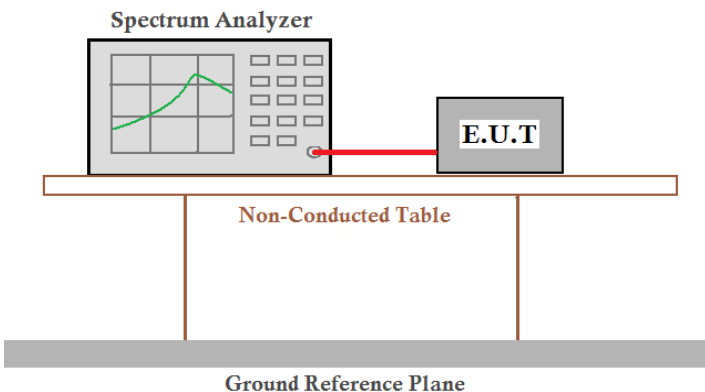
	Freq	ReadAntenna	Cable	Aux	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Factor	Level	Line	Limit
		dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB
1	1199.079	19.19	24.32	3.31	0.00	0.00	46.82	74.00	-27.18 Peak
2	1199.079	11.26	24.32	3.31	0.00	0.00	38.89	54.00	-15.11 Average

Remark:

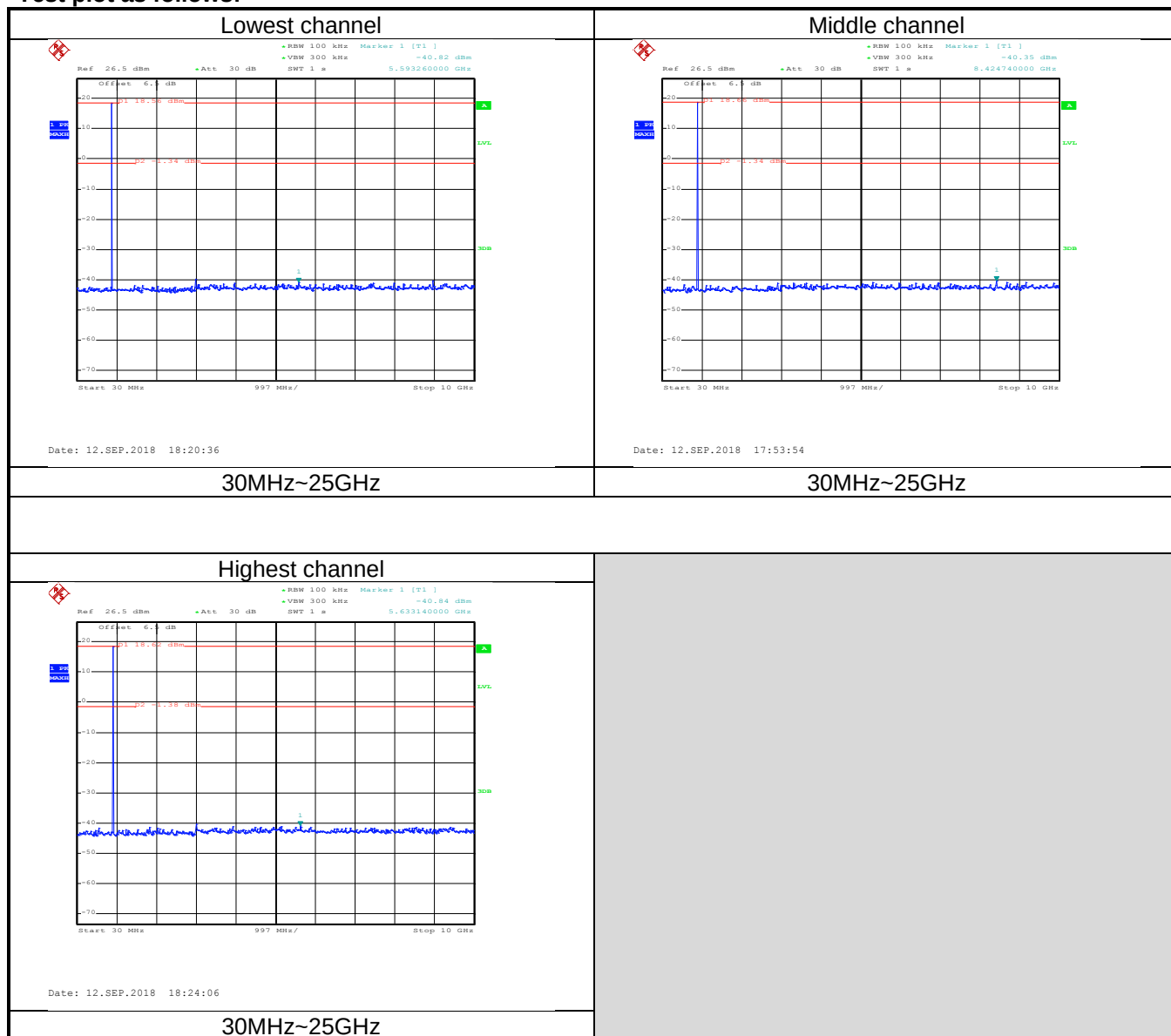
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

6.7 Spurious Emission

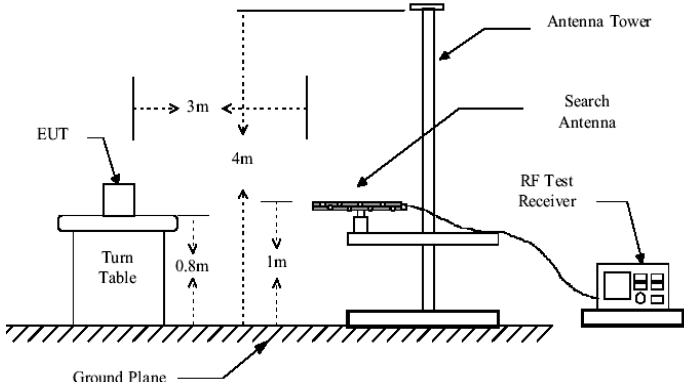
6.7.1 Conducted Emission Method

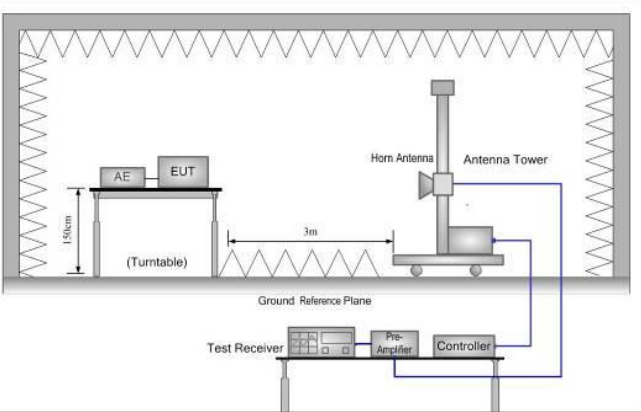
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurements. A Spectrum Analyzer, shown with a green trace on its screen, is connected to an Equipment Under Test (E.U.T.) by a red cable. Both the Spectrum Analyzer and the E.U.T. are positioned on a 'Non-Conducted Table'. This table is supported by two vertical legs and rests on a 'Ground Reference Plane', which is represented by a thick grey horizontal bar at the bottom of the setup.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Comply with 30dBc requirement , Passed

Test plot as follows:



6.7.2 Radiated Emission Method

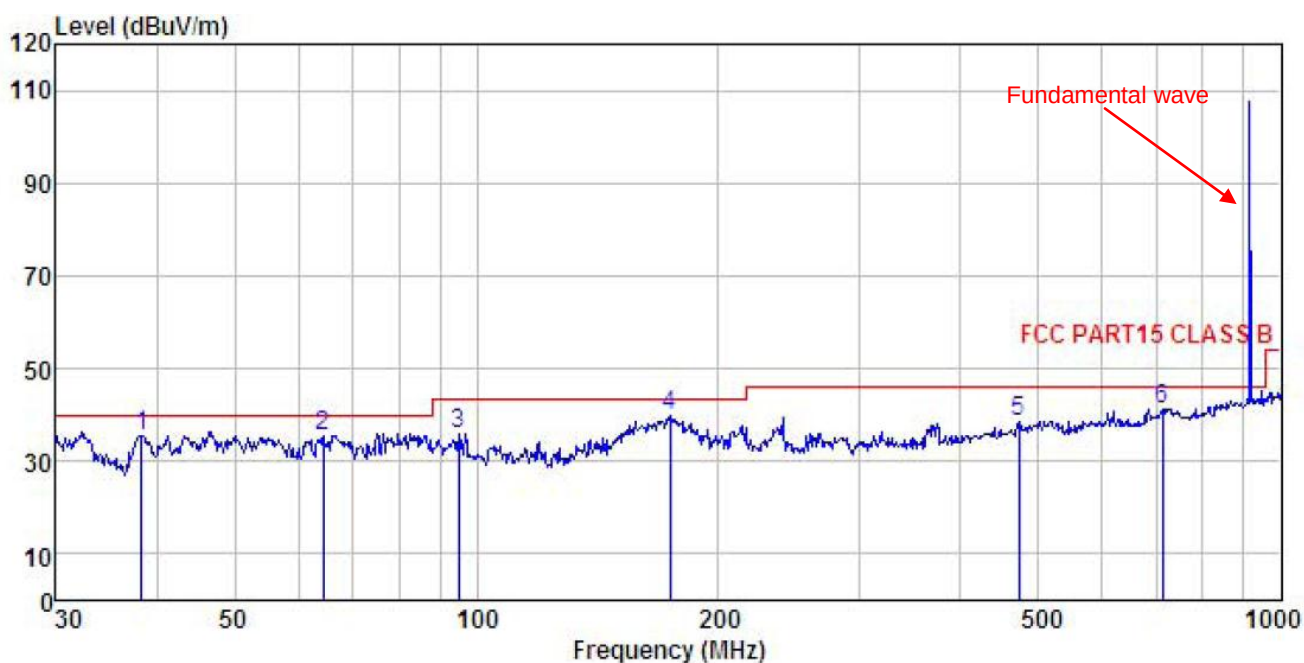
Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
	Above 1GHz		54.0		Average Value
			74.0		Peak Value
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test setup:	Below 1GHz				
	 Above 1GHz				

	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):

Below 1GHz:

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Humi: 57%

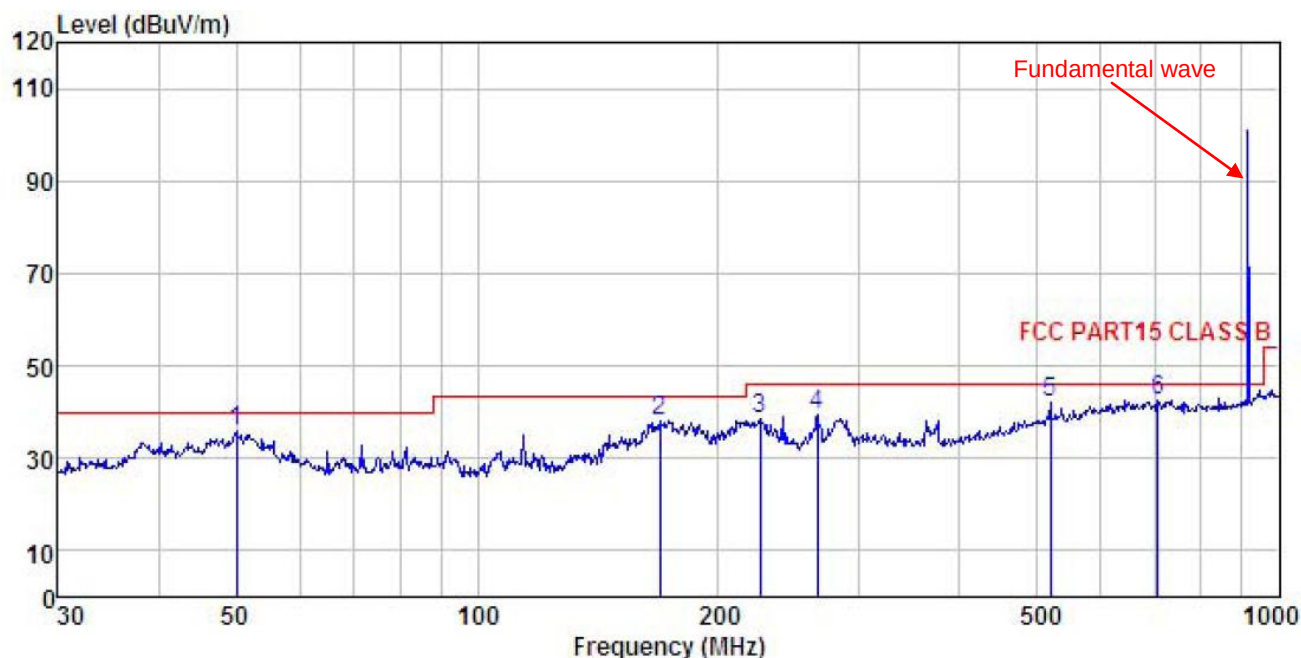


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	38.346	21.91	12.45	1.18	0.00	0.00	35.54	40.00	-4.46	QP
2	64.433	23.37	10.87	1.38	0.00	0.00	35.62	40.00	-4.38	QP
3	95.093	23.14	10.89	2.01	0.00	0.00	36.04	43.50	-7.46	QP
4	173.814	27.46	9.56	2.68	0.00	0.00	39.70	43.50	-3.80	QP
5	472.176	18.27	16.74	3.38	0.00	0.00	38.39	46.00	-7.61	QP
6	711.674	17.08	20.09	4.22	0.00	0.00	41.39	46.00	-4.61	QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%



	Freq	ReadAntenna	Cable	Aux	Preamp	Level	Limit	Over	Remark
	MHz	Level	Factor	Loss	Factor	Factor	Line	Limit	
		dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB
1	50.057	20.54	14.09	1.25	0.00	0.00	35.88	40.00	-4.12 QP
2	169.005	25.99	9.37	2.65	0.00	0.00	38.01	43.50	-5.49 QP
3	225.308	23.09	12.46	2.84	0.00	0.00	38.39	46.00	-7.61 QP
4	265.676	23.38	13.40	2.85	0.00	0.00	39.63	46.00	-6.37 QP
5	519.065	20.86	17.70	3.72	0.00	0.00	42.28	46.00	-3.72 QP
6	706.700	18.41	19.97	4.20	0.00	0.00	42.58	46.00	-3.42 QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz:

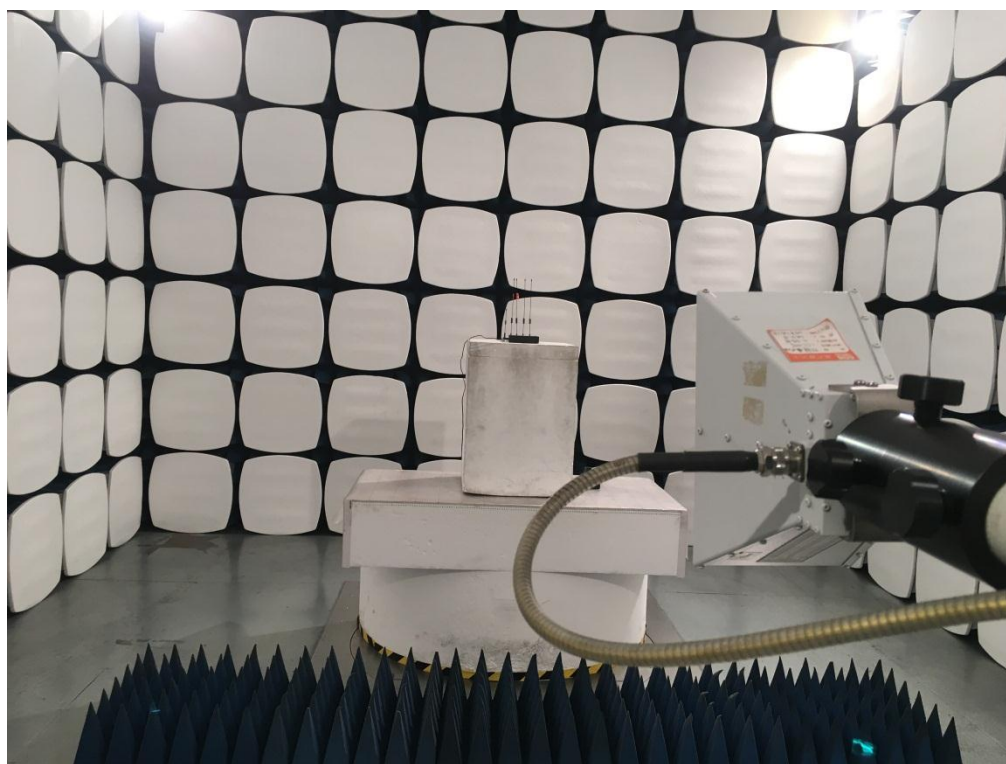
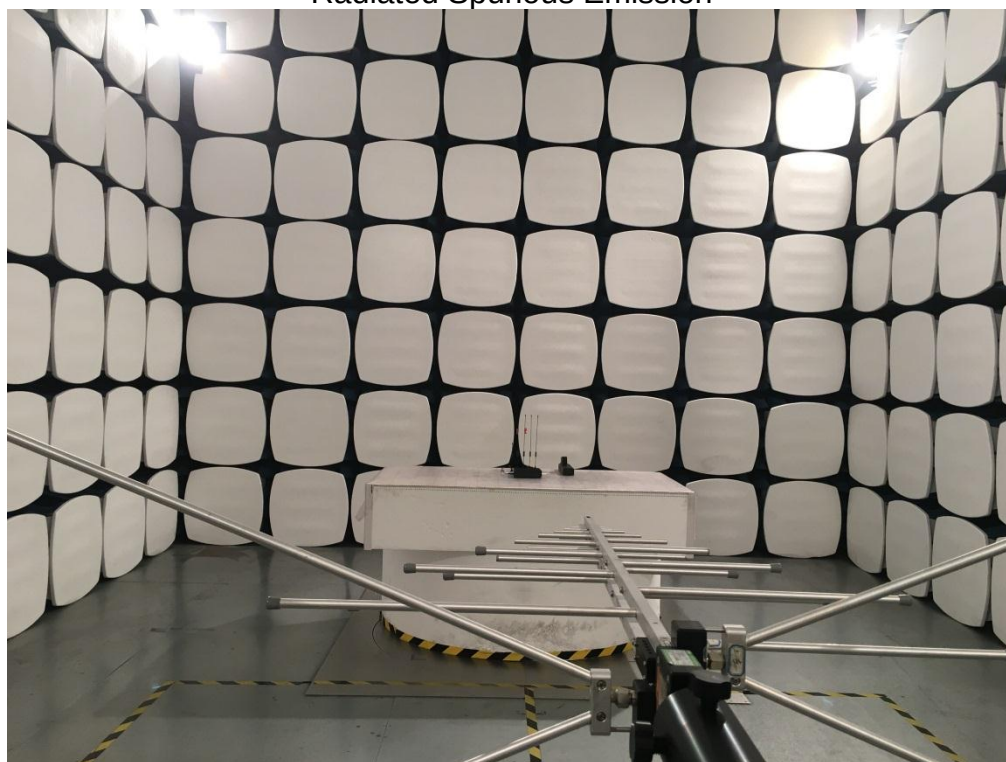
Test channel: Lowest channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1806.00	58.68	25.98	4.12	41.22	47.56	74.00	-26.44	Vertical
2709.00	67.61	28.04	5.05	41.76	58.94	74.00	-15.06	Vertical
3612.00	49.73	29.21	5.90	41.55	43.29	74.00	-30.71	Vertical
4515.00	50.27	31.13	6.82	42.07	46.15	74.00	-27.85	Vertical
5418.00	46.50	32.32	7.13	41.86	44.09	74.00	-29.91	Vertical
1806.00	58.08	25.98	4.12	41.22	46.96	74.00	-27.04	Horizontal
2709.00	66.42	28.04	5.05	41.76	57.75	74.00	-16.25	Horizontal
3612.00	50.85	29.21	5.90	41.55	44.41	74.00	-29.59	Horizontal
4515.00	48.94	31.13	6.82	42.07	36.48	74.00	-37.52	Horizontal
5418.00	46.45	32.32	7.13	41.86	44.04	74.00	-29.96	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1806.00	50.23	25.98	4.12	41.22	39.11	54.00	-14.89	Vertical
2709.00	56.48	28.04	5.05	41.76	47.81	54.00	-6.19	Vertical
3612.00	41.19	29.21	5.90	41.55	34.75	54.00	-19.25	Vertical
4515.00	41.25	31.13	6.82	42.07	37.13	54.00	-16.87	Vertical
5418.00	37.58	32.32	7.13	41.86	35.17	54.00	-18.83	Vertical
1806.00	50.23	25.98	4.12	41.22	39.11	54.00	-14.89	Vertical
1806.00	50.49	25.98	4.12	41.22	28.23	54.00	-25.77	Horizontal
2709.00	56.15	28.04	5.05	41.76	47.48	54.00	-6.52	Horizontal
3612.00	41.51	29.21	5.90	41.55	35.07	54.00	-18.93	Horizontal
4515.00	39.86	31.13	6.82	42.07	35.74	54.00	-18.26	Horizontal
5418.00	38.57	32.32	7.13	41.86	36.16	54.00	-17.84	Horizontal
Remark:								
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.								
2. The emission levels of other frequencies are very lower than the limit and not show in test report.								

Test channel: Middle channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1854.00	58.97	26.02	4.15	41.27	47.87	74.00	-26.13	Vertical
2781.00	65.99	28.12	5.08	41.72	57.47	74.00	-16.53	Vertical
3708.00	48.69	29.34	5.95	41.62	42.36	74.00	-31.64	Vertical
4635.00	47.86	31.23	6.87	42.12	43.84	74.00	-30.16	Vertical
5562.00	46.77	32.39	7.20	41.83	44.53	74.00	-29.47	Vertical
1854.00	58.02	26.02	4.15	41.27	46.92	74.00	-27.08	Horizontal
2781.00	62.10	28.12	5.08	41.72	53.58	74.00	-20.42	Horizontal
3708.00	46.89	29.34	5.95	41.62	40.56	74.00	-33.44	Horizontal
4635.00	47.14	31.23	6.87	42.12	36.48	74.00	-37.52	Horizontal
5562.00	46.93	32.39	7.20	41.83	44.69	74.00	-29.31	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1854.00	50.23	26.02	4.15	41.27	39.13	54.00	-14.87	Vertical
2781.00	56.37	28.12	5.08	41.72	47.85	54.00	-6.15	Vertical
3708.00	40.15	29.34	5.95	41.62	33.82	54.00	-20.18	Vertical
4635.00	39.63	31.23	6.87	42.12	35.61	54.00	-18.39	Vertical
5562.00	38.14	32.39	7.20	41.83	35.90	54.00	-18.10	Vertical
1854.00	50.61	26.02	4.15	41.27	28.23	54.00	-25.77	Horizontal
2781.00	54.85	28.12	5.08	41.72	46.33	54.00	-7.67	Horizontal
3708.00	38.55	29.34	5.95	41.62	32.22	54.00	-21.78	Horizontal
4635.00	39.58	31.23	6.87	42.12	35.56	54.00	-18.44	Horizontal
5562.00	37.58	32.39	7.20	41.83	35.34	54.00	-18.66	Horizontal
Remark:								
3. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.								
4. The emission levels of other frequencies are very lower than the limit and not show in test report.								

Test channel: Hight channel							
Detector: Peak Value							
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Polarization
1845.00	57.61	26.08	4.17	41.32	46.54	74.00	Vertical
2767.50	60.50	28.19	5.12	41.68	52.13	74.00	Vertical
3690.00	47.56	29.47	6.00	41.68	41.35	74.00	Vertical
4612.50	47.72	31.32	6.88	42.07	43.85	74.00	Vertical
5535.00	46.36	32.52	7.27	41.80	44.35	74.00	Vertical
1845.00	54.05	26.08	4.17	41.32	42.98	74.00	Horizontal
2767.50	58.97	28.19	5.12	41.68	50.60	74.00	Horizontal
3690.00	47.56	29.47	6.00	41.68	41.35	74.00	Horizontal
4612.50	48.25	31.32	6.88	42.07	44.38	74.00	Horizontal
5535.00	47.23	32.52	7.27	41.80	45.22	74.00	Horizontal
Detector: Average Value							
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Polarization
1845.00	49.58	26.08	4.17	41.32	38.51	54.00	Vertical
2767.50	51.24	28.19	5.12	41.68	42.87	54.00	Vertical
3690.00	40.36	29.47	6.00	41.68	34.15	54.00	Vertical
4612.50	40.14	31.32	6.88	42.07	36.27	54.00	Vertical
5535.00	38.55	32.52	7.27	41.80	36.54	54.00	Vertical
1845.00	47.36	26.08	4.17	41.32	36.29	54.00	Horizontal
2767.50	46.89	28.19	5.12	41.68	38.52	54.00	Horizontal
3690.00	39.87	29.47	6.00	41.68	33.66	54.00	Horizontal
4612.50	40.51	31.32	6.88	42.07	36.64	54.00	Horizontal
5535.00	39.55	32.52	7.27	41.80	37.54	54.00	Horizontal
Remark: 5. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor. 6. The emission levels of other frequencies are very lower than the limit and not show in test report.							

7 Test Setup Photo

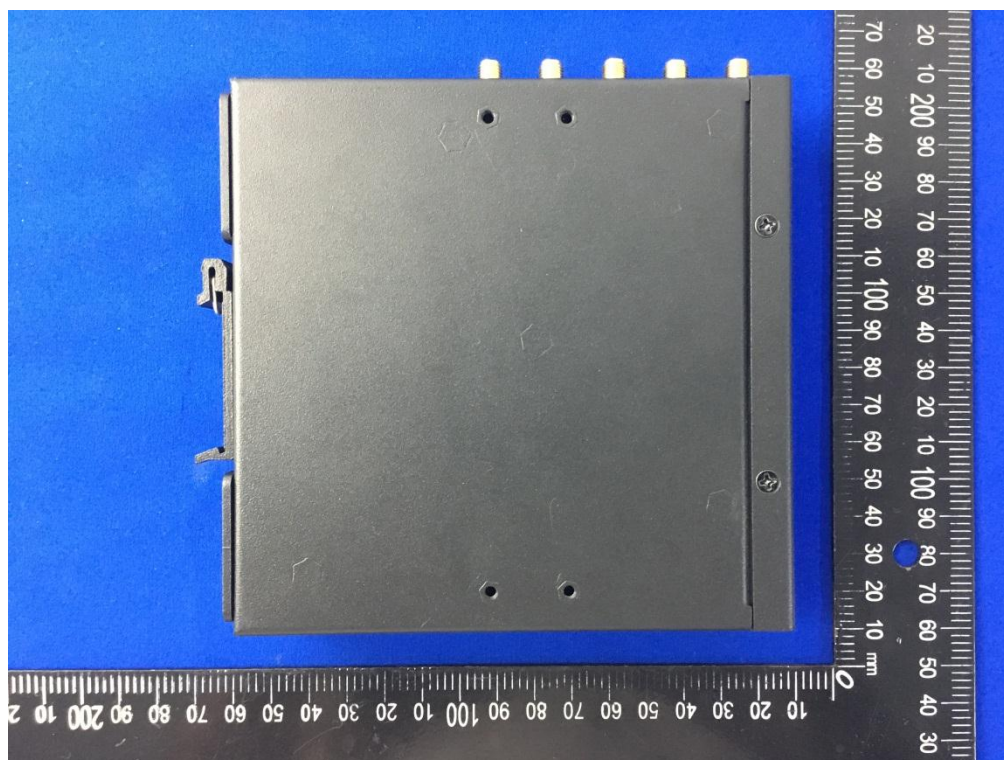
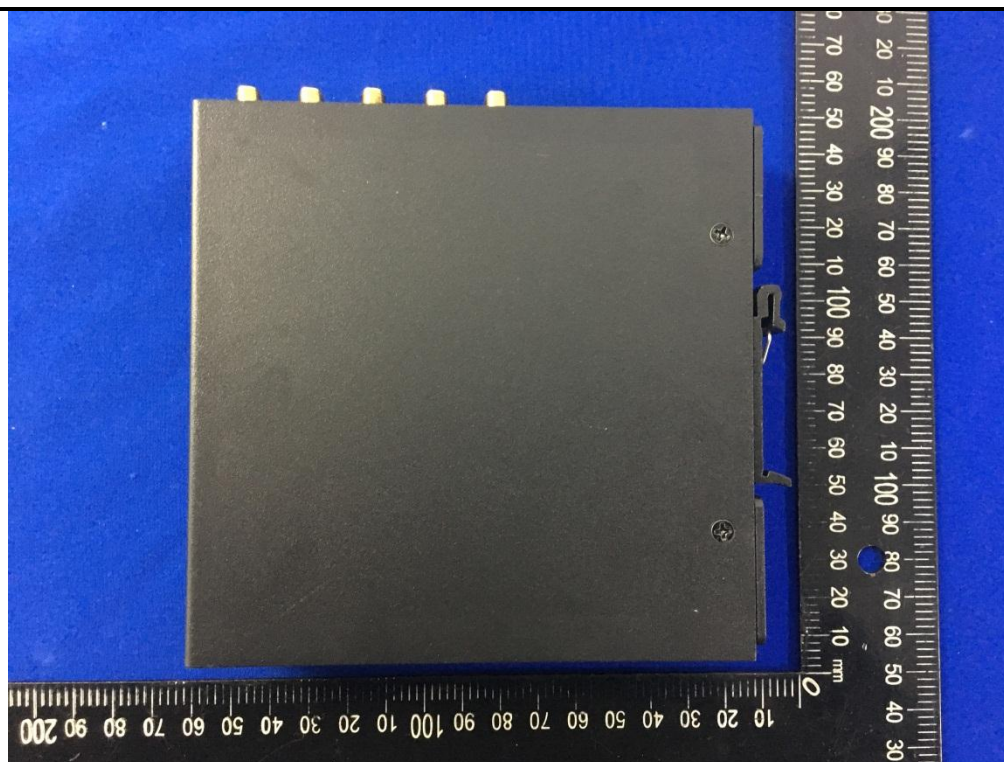
Radiated Spurious Emission

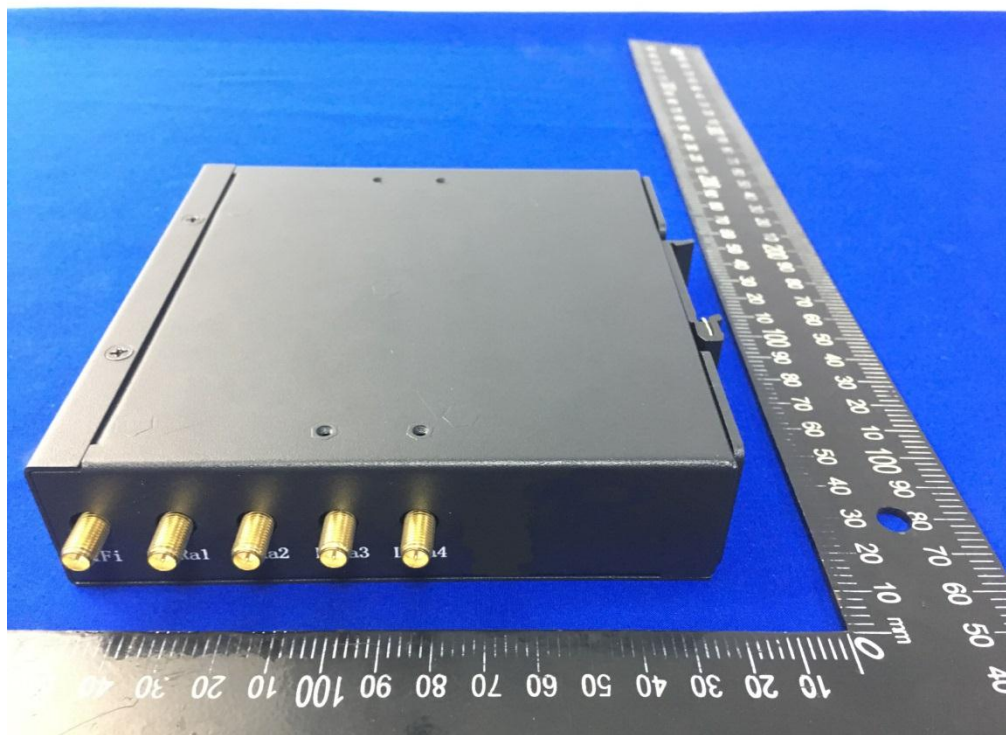
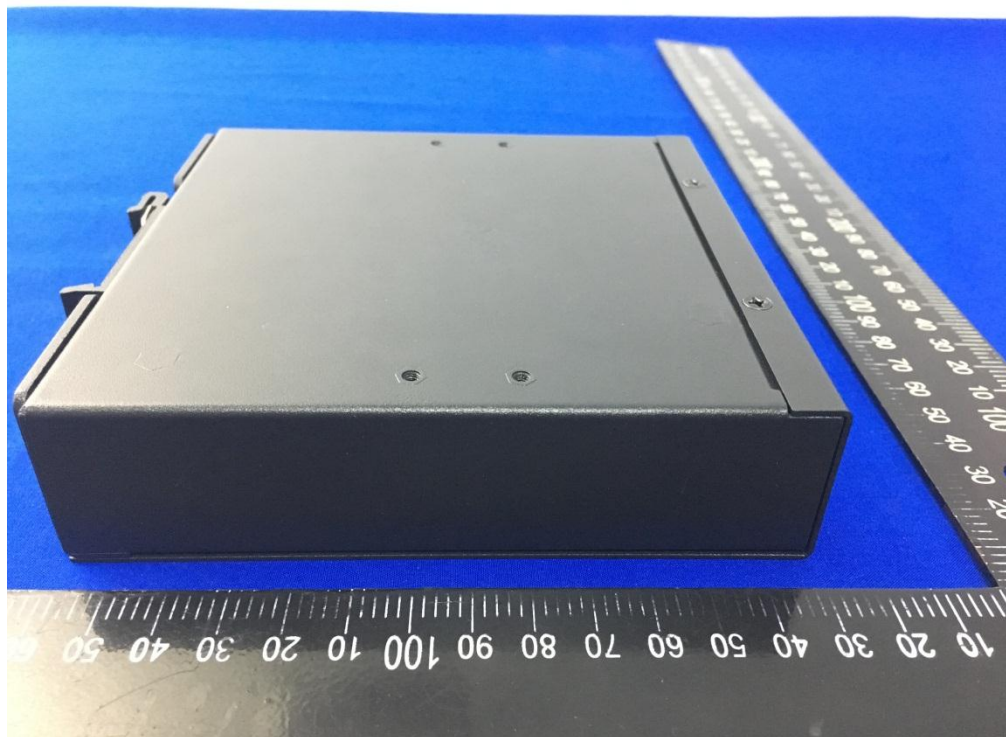


Conducted Emission

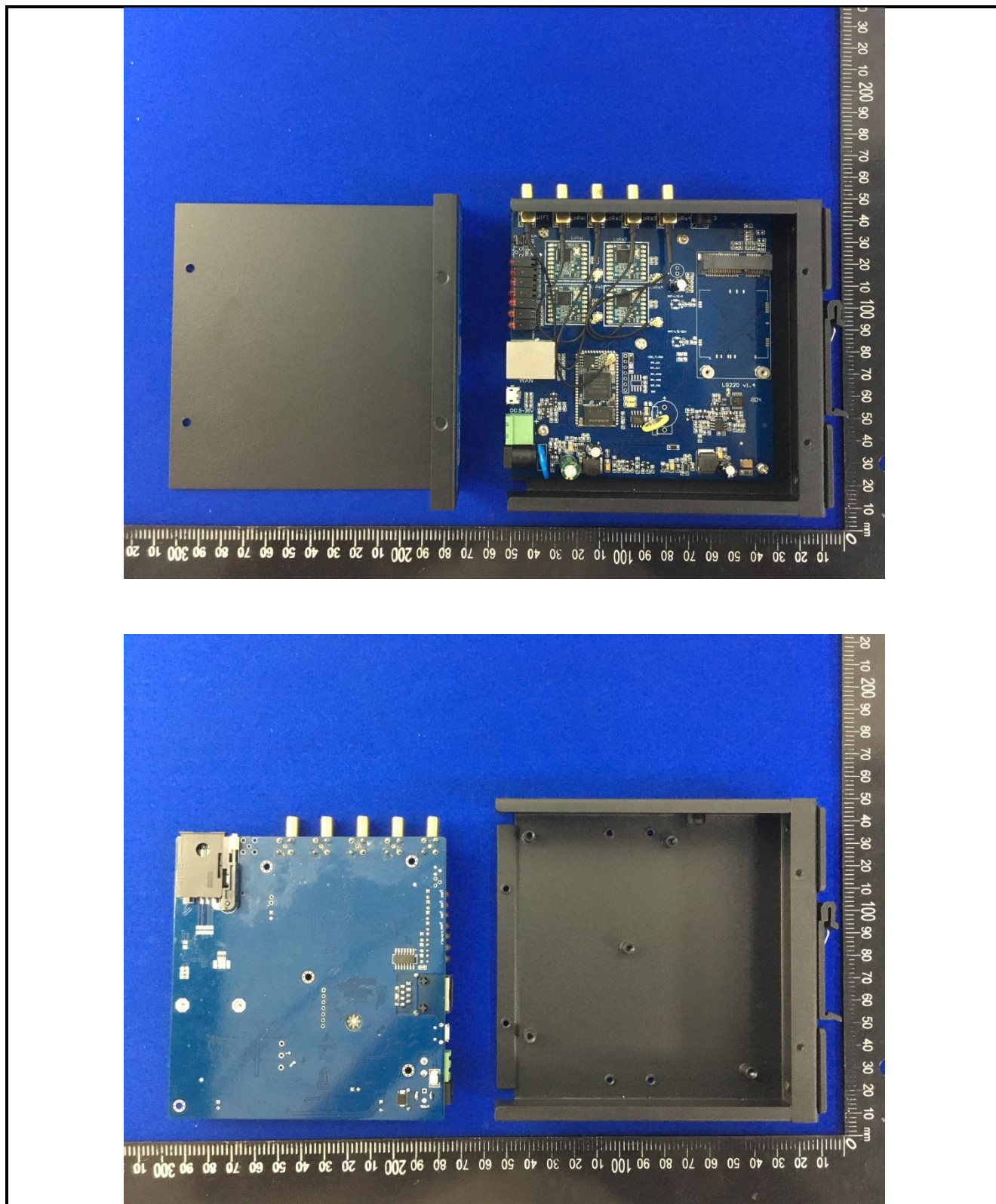


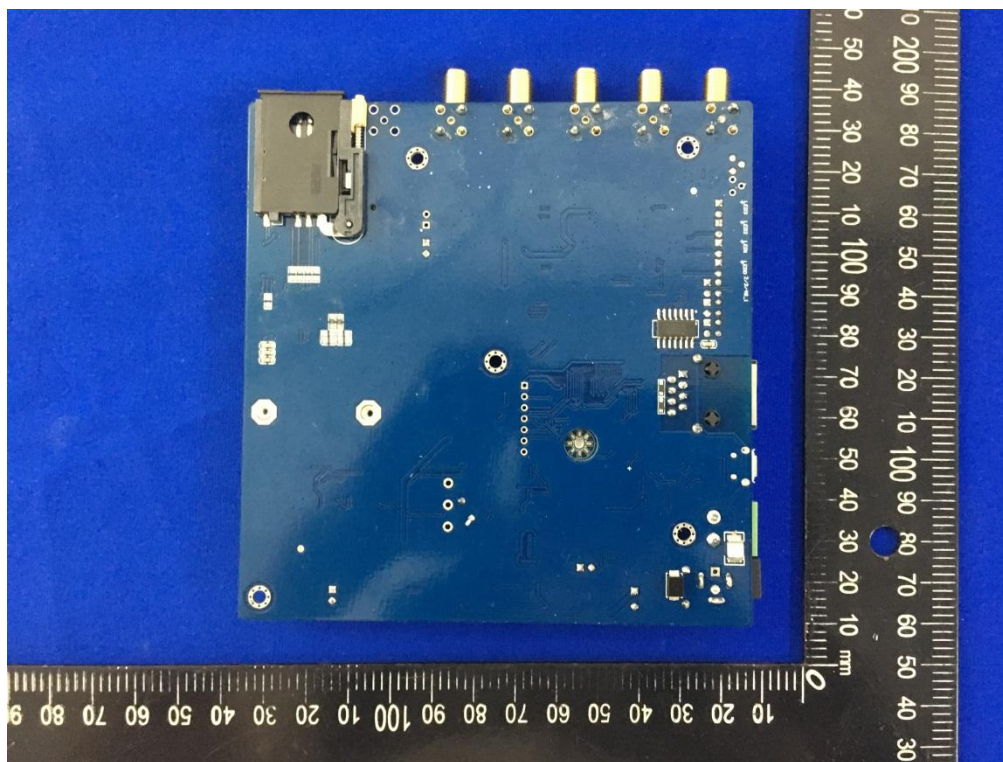
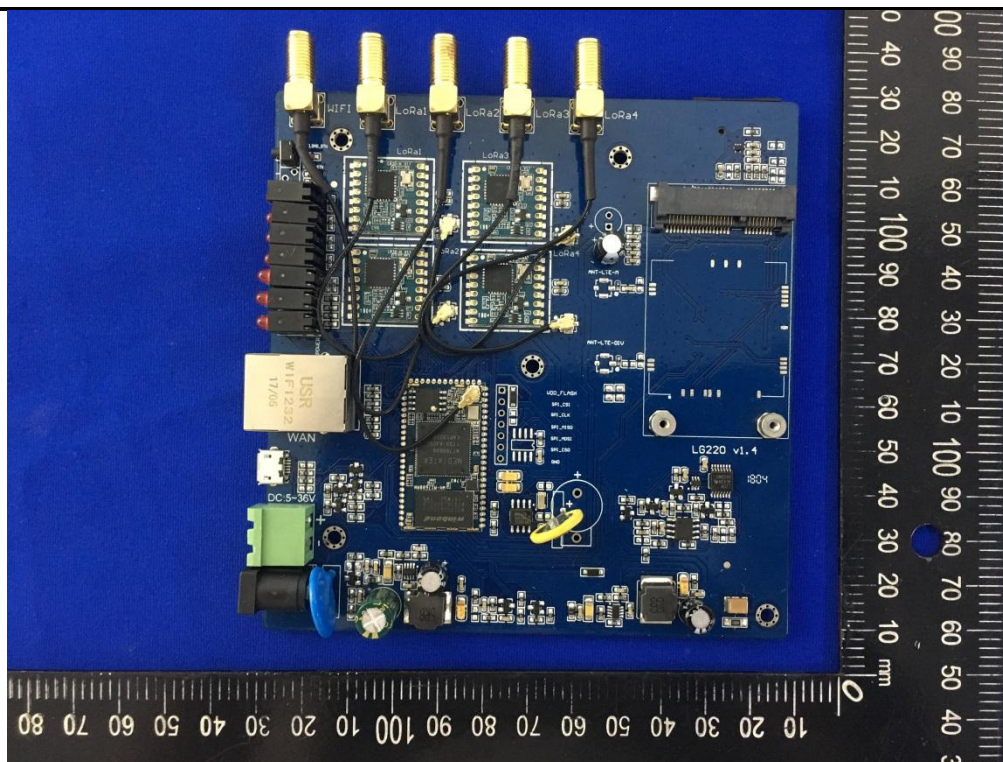
8 EUT Constructional Details

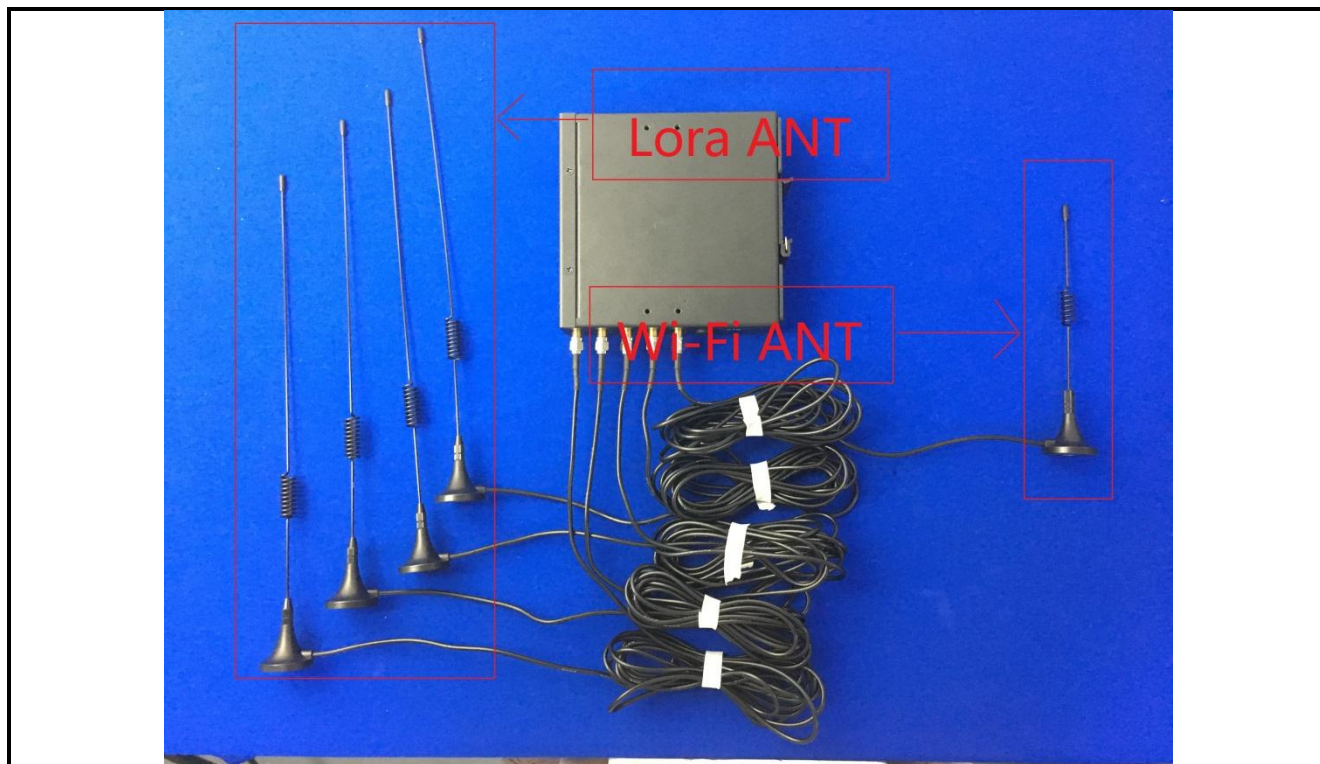












-----End of report-----